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(54) Abrasive materials

(57) Abrasive grains are provided with improved uniformity and an enhanced grain structure by thermal treatment, e.g. in a plasma flame. The treated grains may be sprayed directly on a substrate in the manufacture or refurbishment of an abrasive device.

The drawing originally filed was informal and the print here reproduced is taken from a later filed formal copy.

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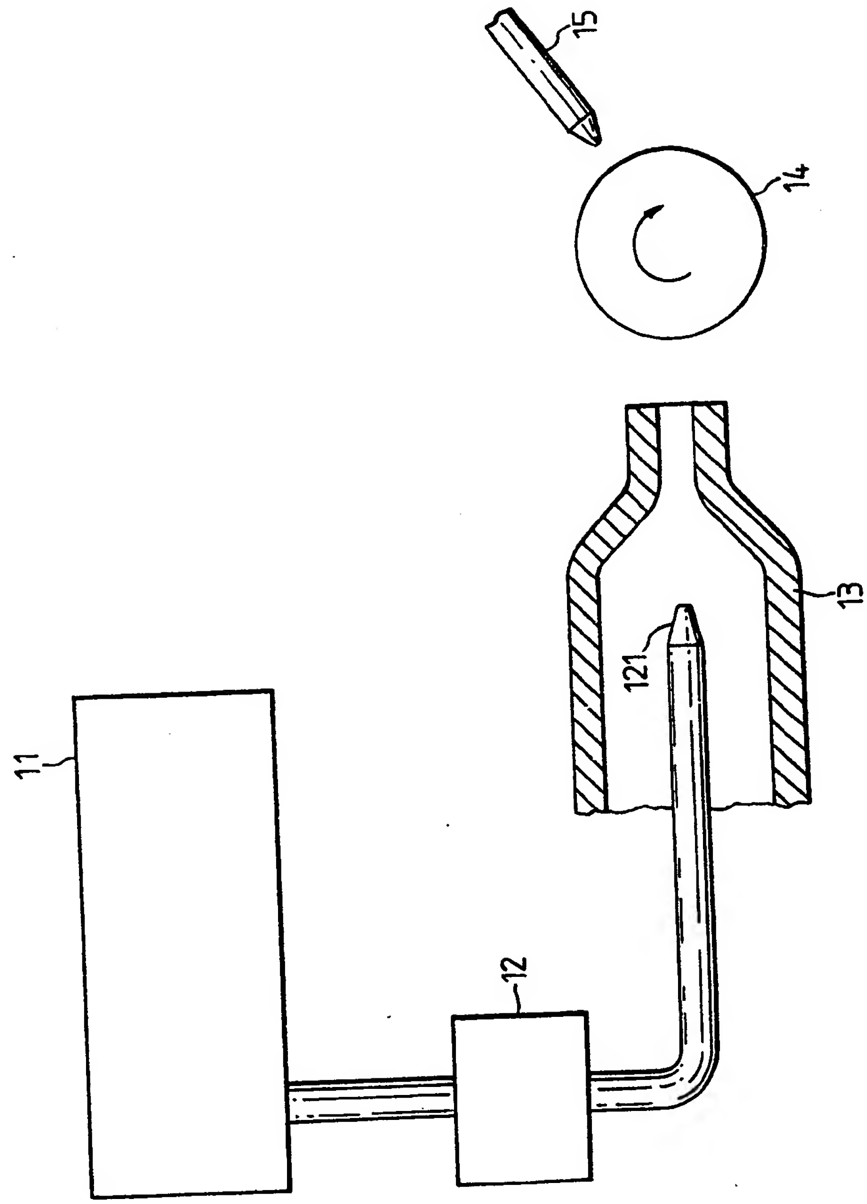
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SPECIFICATION

Abrasive materials

This invention relates to techniques for producing abrasive materials and to abrasive devices produced therefrom.

Abrasive devices, for example grinding wheels, abrasive cloths etc., are conventionally made from a refractory abrasive material that has been crushed to a suitable particle size. Crushing processes involve a number of disadvantageous features in an abrasive product. In particular highly irregular particles are obtained and many of the particles are weakened by partial fracture. Furthermore devices such as grinding wheels are subject to wear and are then difficult to refurbish with conventionally prepared abrasive materials.

The object of the present invention is to minimise or to overcome these disadvantages.

According to one aspect of the invention there is provided a process for preparing a particulate abrasive material, the process including exposing said abrasive in particulate form to a plasma or a combustible gas flame, and rapidly cooling the abrasive to ambient temperature thereby enhancing the grain structure of the abrasive.

According to another aspect of the invention there is provided a process for manufacturing or refurbishing an abrasive device, the method including heat treating a refractory particulate abrasive product in a plasma or a combustible gas flame, thereby enhancing the grain structure of the abrasive, and applying the heat treated abrasive together with a binder to a substrate surface.

We have found that thermal treatment, particularly at the temperatures experienced in a plasma flame, improves the regularity of abrasive particles and enhances their grain structure thus significantly improving their abrasive qualities and their wear resistance. Advantageously the heat treated particles may be applied via the flame to a substrate surface. Such a technique may be employed both in the manufacture and the refurbishing of abrasive devices.

An embodiment of the invention will now be described with reference to the accompanying drawing in which the single figure is a schematic diagram of an apparatus for manufacturing an abrasive device, e.g. a grinding wheel.

Referring to the drawing the apparatus includes a crusher and sieve arrangement 11 whereby refractory abrasive particles of a predetermined size range are formed for a 'raw' abrasive abrasive material. The abrasive grains produced by the crusher 11 are then fed to an injector 12 from which they are directed via a gas jet stream into a flame generator 13. Typically the flame generator 13 comprises a plasma torch which may be of the direct current, alternating current or microwave type.

The flame produced by the generator 13 is of a sufficiently high temperature to fuse the surface of each abrasive particle thus removing major surface irregularities. At the same time heat is transferred to the inner regions of each particle and, whilst complete fusion of the inner regions does not necessarily occur, owing to the poor thermal conductivity of most abrasive materials, annealing is effected thus enhancing and improving the grain structure of the abrasive. This has the effect of repairing fracture damage introduced by the crushing process and of providing particles of a relatively uniform shape. Advantageously the abrasive particles may be coated with a lower melting point nitreous phase either prior to or during the flame treatment process.

The flame treated particles are directed via the flame on to a substrate 14 which may comprise e.g. a grinding wheel or, for some applications, a continuous belt. The substrate 14 is provided with a precoating 15 of a binder material, typically a heat curable plastics resin, to which the abrasive particles adhere. Advantageously the surface of the substrate 14 is moved through the flame and is coated with liquid resin from a spray nozzle 15 immediately prior to deposition of the hot abrasive. The heat released from the deposited abrasive then includes rapid curing of the resin. Deposition may be effected as a single layer or a multilayer structure may be built up by a succession of deposition steps.

We have found that in addition to improving the properties of a refractory abrasive material the flame spraying technique also provides the deposited material layer with a desirable degree of porosity. This reduces the tendency of the abrasive device, in use, to become clogged with abraded material.

A variety of abrasive materials may be employed with the techniques described herein. Examples of such materials include, but are not limited to, aluminium oxide or corundum, aluminium carbide or carborundum, silica, tungsten carbide and silicon carbide.

The flame deposition technique may be employed not only in the manufacture of new abrasive devices but also in the repair of cross devices. Thus, for example, the technique may be employed to repair surface damage to worn grinding wheels and sanding belts.

CLAIMS

1. A process for preparing a particulate abrasive material, the process including exposing said abrasive in particulate form to a plasma or a combustible gas flame, and rapidly cooling the abrasive to ambient temperature thereby enhancing the grain structure of the abrasive.

2. A process as claimed in claim 1, wherein said abrasive is aluminium oxide, aluminium carbide silica, tungsten carbide, silicon carbide or mixtures thereof.

3. A process for preparing an abrasive material substantially as described herein with reference to the accompanying drawing.

4. An abrasive powder produced by the method of claim 1, 2 or 3.

5. A process for manufacturing or refurbishing an abrasive device, the method including heat

treating a refractory particulate abrasive product in a plasma or a combustible gas flame, thereby enhancing the grain structure of the abrasive, and applying the heat treated abrasive together with a binder to a substrate surface.

6. A process as claimed in claim 5, wherein said binder is a heat curable plastics resin.

7. A process as claimed in claim 5 or 6, wherein said abrasive particles are coated with a lower melting point vitreous phase.

8. A process as claimed in claim 5, 6 or 7, wherein the abrasive is applied to the substrate as a multilayer deposit.

9. A process for manufacturing or refurbishing an abrasive device, which process is substantially as described herein with reference to the accompanying drawing.

10. An abrasive device manufactured or refurbished by a process as claimed in any one of claims 5 to 9.

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